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ANTHROPOLOGY AND GROWTH[1]

By Dr. T. WINGATE TODD

PROFESSOR OF ANATOMY, WESTERN RESERVE UNIVERSITY; CHAIRMAN OF THE BRUSH FOUNDATION

IT would be interesting to review the history of any scientific discipline to its early days when it struggled for a mastery of its subject and note how, while it was still young and insecure, it was seized and held in bondage by a facetious charlatanry which impeded progress and held it up to derision. Chemistry, medicine, astronomy, geography, zoology flash as examples before the mind. Each in turn emancipated itself and the story of its emancipation gives to the thoughtful a thrill of satisfaction at the triumph of earnest effort over dismaying difficulties. It is, however, much more thrilling to watch the actual struggle of a science to free itself from handicap and secure for itself a prestige based upon unimpeachable technique, sound deduction and service to humanity. In physical anthropology that exciting phase has now been reached and to-day we have the privilege of watching the bursting of the entrammeling bonds of political and legislative domination by which it was enslaved during the nineteenth and early twentieth centuries.

It may be impossible to pick out the mind to which, of all others, a science is indebted for its emancipation, or to point to that particular contribution which contains the spark of quickening fire, and I arrogate neither infallibility nor omniscience in this respect. As I write these words my eyes lift to the original photograph, now famous by countless copies distributed throughout the world, of his father taken by Major Leonard Darwin and presented to me as chairman of the Brush Foundation in generous encouragement of Dr. Brush's aim for betterment of the human stock. We do not attribute to Charles Darwin the first conception of evolution nor do we assert that the doctrine set forth by him would serve in its original form for all time, but we do acknowledge his

[1] Address of the vice-president and chairman of the Section of Anthropology, American Association for the Advancement of Science, Pittsburgh, December 28, 1934.

work as a source of inspiration and guidance to biological thought forever.

If then, in gratitude and in acknowledgment of indebtedness which many in this room must share, I single out one mind and one piece of work for mention in my presentation, it must be understood that personal scientific indebtedness and a sense of prophecy for the future find expression in this act of homage.

It seems to me that when Professor Boas described the changes in head form in children of immigrants he set a new furrow in the anthropological field and as it turns out, I believe, a master furrow. So deeply ingrained is the doctrine of predestination which, in its scientific form, is of course the law of heredity, that Boas's announcement was scornfully rejected by some who might have known the value of finding facts first. But that incident is long past and the principle involved in Boas's conclusion has quickly permeated the modern attitude to physical anthropological problems. The adult form of mankind is the outcome of growth enhanced, dwarfed, warped or mutilated by the adventures of life.

I am not decrying heredity. In this chair I follow an able and convincing exponent of its value for mankind. But I do insist that new knowledge gained for anthropology through the study of growth brings hope and confidence where formerly was only the grim figure of destiny.

Now the differences in head form between parents and their foreign-born children on the one hand and their native-born children on the other center in the face and characterize its transverse dimensions. That central European people transferred to the east side of New York should find conditions of life vastly changed needs no emphasis. The difference of paramount significance for the nursing mother and growing child lies in the price of perishable foods, particularly milk and fresh vegetables. Changes in family dietary are inevitable, and while these changes can not affect adult bodily form they do have a profound influence upon the actively growing structures of infancy and early childhood.

That this is no illusion is evident from the careful comparisons of the Bakwins who have shown that undernourished or malnourished children suffer more in the growth of their transverse than of their longitudinal dimensions. And that this distinction characterizes body as well as head merely extends the field of operation of nutritional influences. It does not invalidate but intensifies Boas's original contention.

Years ago Jackson fed very young rats upon a diet which was satisfactory for health but not ample enough to increase the body weight. These animals did not fail to grow. They grew less rapidly than the normal controls and their ultimate size was less. But the striking thing about them was not shortness of body but the deficiency in transverse dimensions. This is not a characteristic of starvation. It results from nutritional defect and is equally well seen in the growing guinea pigs fed by Dr. Zuck on large amounts of thyroid gland.

It is a curious and intriguing fact that the face is extraordinarily sensitive to disturbances of growth. Owing to the kindness of Drs. Sutherland Simpson and H. S. Liddell, of Cornell University, Dr. Wharton and I were given the opportunity to study postnatal physical growth in the sheep following thyroidectomy at about one month after birth. Compared with the growth of normal twin controls these thyroidectomized animals showed a definite interruption of growth in those parts of the face between orbit and mouth the growth of which is most rapid in the early months of the sheep's life. The cretin sheep never grows to the size of its normal control, but this is due to a reduction in velocity of bodily growth whereby, when the period of growth, which we shall later consider somewhat more intently, is over a relatively poor result is attained. The dynamic centers of growth in the face have their maximum activity early in life and, growth being more seriously handicapped at that particular time, they suffer most.

That disturbances of facial growth occur in human childhood is abundantly clear from the work of Broadbent and Hellman. The detailed studies of the former are a part of the program of the Bolton Study, of which Broadbent is director, the Bolton Study being one of the Associated Foundations grouped about my laboratory and engaged in the investigation of the growing child. Broadbent's observations demonstrate in malnourished infants a marked diminution of growth velocity in the dynamic centers of the face. Hellman has shown that during the first five years of life growth is more active in antero-posterior and transverse dimensions of the face, whereas the most vigorous vertical growth occurs after the fifth birthday. It is particularly in transverse and antero-posterior facial dimensions that we must look for the defects of early malnutrition. Recrudescence of growth occurs after the effect of the disturbance is eliminated or compensated, but by then adjustments have taken place and the growth pattern is permanently modified.

Now in emphasizing particularly the effect of malnutrition upon facial growth one must not appear to belittle the heritable factors which plainly direct the general course of growth. We call the expression of this heredity the family line. But any one who has studied families, especially those which represent two or three generations and include growing children, is aware of marginal examples, for the principle of

heredity is one thing and its expression in bodily form is another. We have, among the children studied by the Associated Foundations in Cleveland, many examples of what appears to be a modification in the younger children of family growth pattern as exemplified by the older ones so that it is unsafe to predict the course of growth in successive members of the family. But, whereas most members tend to pursue a common course of developmental growth statistically expressed as regression towards the mean, these marginal individuals occur as examples of intensified family characters, people to whom a double portion has accrued for good or evil.

I shall not dwell further upon marginal individuals but would refer to two other aspects of the heredity problem before I pass on. The first is the ease with which some bodily features can be changed and the stubbornness of others in resisting interference. This theme is well illustrated in hybridization and has its very distinct bearing on the choice and weighting of dimensions used in calculating the coefficient of racial likeness. The American Negro is a good example whose entrenched features I have discussed on a former occasion. The second is the ever-present problem of mental defect. Penrose's recent observations show that the intelligence quotient of the relatives of idiots is higher than that of the relatives of simpletons. There is a rapidly accumulating mass of evidence which indicates that the origin of simple-mindedness lies more in environmental conditions, whereas that of idiocy lies in primary structural defects of the brain. Our solution of the social problems resulting from these two diverse forms of mental inadequacy must therefore be devised on equally diverse lines. The existence of simple-mindedness focuses our attention on the conservation of healthy developmental growth in the prenatal period and in infancy. The problem of idiocy is less insistent because of the family limitation which occurrence of idiocy tends to produce.

This brings us to the contemplation of the constructive social contribution in physical anthropology. Since cumulative anthropological observation shows that hereditary patterns can be modified by conditions of life it ought to be possible to improve the physical status of mankind. Fortunately there is to hand definite evidence of this in the Lanarkshire milk experiment. The free distribution of milk to the school children of this Scottish county has proved statistically that healthy growth can easily be promoted by adequate and appropriate diet. It is significant that the improved growth was most evident in the older children, especially the girls of the family, the inference being that, on a smaller family ration, most of the milk went to the younger children. As far as health is concerned we have Dr. Corry Mann's testimony to the greater irrepressibility of school boys on an adequate milk ration. Following these investigations Sir J. B. Orr makes the plea for regulation of nutrition as the most important of state questions to-day.

Since the statistical survey of growth presents such encouraging conclusions it is incumbent on anthropologists to devise a technique in the long-term quantitative study of growth for the accumulation of data of real social significance. Suggestions for the planning of this study are therefore timely. But as our present information is limited attention may be directed to a few examples.

Long ago Sir Arthur Keith subdivided growth into functional and corporeal concomitants. Any organ, he claimed, must grow to a certain size before it is functionally adequate. Thereafter its growth is merely an increase in size commensurate with increasing bodily dimensions.

That organ of the body which definitely reaches earliest functional maturity is the vestibule, the organ of static equilibrium. Streeter's observations show that the vestibule is functionally active in the 20-mm human embryo, shortly before the appearance of those mass movements which serve to keep the embryo balanced in its water bath of amniotic fluid. Beyond this stage and up to the time of birth the vestibule continues to grow, but this growth exemplifies Keith's corporeal concomitant. After birth there is no further growth: the vestibule is already adult in size.

The observations of Feldberg and Disse demonstrate a growth of the olfactory area of the nose greatest before six months after birth. In later infancy the respiratory part of the nose takes on its increased velocity, but the olfactory area, functionally active at birth, displays but a very small corporeal concomitant. In early childhood it is the middle part of the nose which bears the burden of respiratory growth. In later childhood the inferior part unfolds and growth of this area continues approximately to adolescence.

A tooth, or the occlusal surface of it, has no corporeal concomitant but is already fully grown before the enamel organ first lays down mineral in its cusps and long before eruption converts it into a functionally active organ.

Investigation of the eyeball by Beecher and Williams in my laboratory proves that adult size is reached at about four years, the practical implication of this being that defects of vision, which indicate anomaly of growth, must be corrected far earlier in childhood than is customary to-day.

But the eyeball is essentially part of the brain, and it is not surprising therefore that Loo's examination

of the cerebrum in childhood shows that adult configuration of cerebral pattern is attained between the ages of four and six years when the brain case is at least four-fifths adult size. In other words, we send our children to school when all their mental faculties are potentially present awaiting education to transform them into abilities.

The schedule of differential growth in the head is indeed most illuminating for our present purpose. Brain-case growth is characteristic of infancy and early childhood and with it go the antero-posterior and transverse dimensions of the face, including the zygomata or malar arches. Vertical or respiratory growth of the face attains maximum velocity in later childhood. Vertical growth of the jaws between floor of nose and chin reaches its most vigorous phase at and after puberty.

The sexual differences in facial growth provide the next clue in formulating our plan of study. Brain case and upper or respiratory facial growth are common to both sexes and differ solely by the corporeal concomitant. But lower facial growth, from floor of nose to chin, is much greater in the male than in the female. It is characteristic of anthropoids and man that bodily growth in the female practically ceases at puberty, whereas, in the male, it continues for several years. Hence the majority of women present a relatively small jaw growth compared with that of men. That there are individual differences is less a matter of individual variation than a corollary of modified growth pattern at the cause of which we must glance in a few moments.

The fact that there are periods of maximum growth activity for each organ or area of the body gives an opportunity to analyze the final condition found in the adult and to date growth disturbances which may have occurred in that individual's past. Defective cranial size must have dated from infancy, deficient upper facial growth from childhood, inadequate jaw growth from adolescence. None of course can be utilized to localize a date earlier than that of its own maximum activity.

A relatively simple problem in growth is afforded by stature. Standard tables, say the Baldwin-Wood tables, for boys show a yearly increase in stature of about 50 millimeters from six to thirteen and a half years. Between thirteen and a half and fifteen years the average gain is 100 millimeters in eighteen months. This is the so-called adolescent spurt of growth. But a study of the statistical variabilities by Dr. Lerro and Mrs. Wood on the stature of boys under our long-term observation shows that the so-called individual variation sets in earlier and finishes later than these limiting dates. There are, as Boas has pointed out, two groupings of boys with a smaller number of stragglers intermediate in position. The one group passes through adolescence comparatively early and this accounts for the increased coefficient of variability at the younger level, while the other group passes through adolescence relatively late and accounts for the increased variability at the older level. But a study, by Seymour, not yet published, of individual growth curves analyzed into leg and trunk lengths confirms the conclusion drawn by West, some forty years ago, that adolescent increased velocity of growth in stature is the result not so much of increase in rapidity of growth in leg as in enhanced trunk growth. The relatively long legs and short trunk of some people, who are not themselves tall in stature, is due to defect of trunk growth rather than to increase in leg length. One would summarize this study by saying that maximum velocity in leg length is a function of childhood, whereas maximum velocity in trunk length is characteristic of adolescence. The differential in growth of leg and trunk is clearly marked in achondroplastic dwarfs in whom velocity of leg growth is reduced to approximately half the normal, whereas the growth impulse of trunk suffers much less handicap.

Growth in stature is accompanied by growth in pelvic breadth, but there is evidence in our series of children, evidence which is incomplete as yet it is true, that this pelvic growth takes place in three definite successive stages, necks of femora, iliac blades and sacrum in that order. Analysis of the actual growing pattern in intensive studies of individual children suggests that before long we may be able to carry on a far more penetrating study than is now possible.

Mention of the pelvis reminds us that growth is not merely increase in dimensions. A child grows in size but grows up to adulthood. The development or progressive maturation is even more significant than the increase in dimensions. The control of this maturation is not yet clearly defined and much critical analysis must still be carried out before the discordant claims on growth control are convincingly settled. The appearance of menstruation, however, in most but not in all growing girls gives a clue to the relation between dimensional increase and progressive maturity at one level of developmental growth. Whereas the measuring-rod reveals rapid growth in stature before the menarche it shows very little afterward. But roentgenograms of the growing ends of the bones testify to replacement of a lethargy of progress in maturation before by a period of greatly invigorated maturation afterward. The speed of this process in the girl is a matter of common knowledge not yet scientifically stated in quantitative terms. But we expect shortly to be able to make this quantitative assessment not only for girls but for boys as well.

When, in the light of fuller knowledge, a further analysis of constitutional types is made, it is on the lines of developmental growth that these constitutional types will find their explanation. But one must beware the fascination of using this method to explain, in too facile a manner, differences of race or stock.

Having now sketched the relationships of anthropology to growth and outlined the manner in which intensive long-term studies of individuals may be made fruitful of results which in turn can be applied to the resolution of complex adult patterns it is worth a few minutes' attention to turn to the practical application of anthropology in studies of developmental growth.

By enlarging analytic method to include orthodiagraphic tracings and roentgenograms which record developmental maturation, in addition to the present conventional direct measurement and statistical reduction and by recasting our selection of measurements to cover dynamic foci of growth rather than dimensions offered by chance, by ease of determination or by sheer obviousness, physical anthropology can be transformed from a static study of structural form into a kinetic study of structural progress. The recognition of periods of maximal velocity of growth and of developmental maturation for particular organs and areas will clear many a confused problem. It is evident, for example, from Bolk's investigations, that if sutural union occur precociously in the cranium it takes place before the age of seven years. But we have seen that this coincides with the limiting date of maximal velocity of growth in the brain. Irregularity in date of sutural union in human skulls is therefore probably a function of its undue delay and the problem is not to be consigned to the dragnet of individual and meaningless variation.

In application to eugenics the study of structural progress gives a detailed insight into the characteristic features of family lines with their various expression in different members of the family and the development of marginal individuals.

In physical education the investigation of developmental maturation by roentgenographic methods, added to the regular routine physical measurement of dimensional growth, completes the study essential to a wise application of compulsory athletics and solves many a problem of undue fatigue, of muscular tone, of inadequate heart or of deficiency in speed, power and grace.

In scholastic education the anthropologist's wisely used record of differential maturity combined with that of differential growth throws light on vagaries of emotion, on problems of social adjustment, on failure in promotion and the host of problems that beset the teacher of the preadolescent grades four to six.

Lastly in application to clinical medicine determinations of progress in physical maturation qualifying those of growth in stature and weight differentiate the outsize child, the subnormal child, the superior child of advanced physical development, the physical impress of malnutrition, of respiratory allergic disorders such as hay fever and asthma, of the disharmonically progressing child who is a problem to himself as well as to those responsible for his guidance and health.

The serial study of developmental growth is a function of the physical anthropologist not of the physician whose attention is sufficiently occupied with problems of health, but whose effectiveness of management is enhanced by the record of progress made by the anthropologist when this analysis is based on trustworthy determinations of growth and of physical development.

To the newly arisen discipline of orthophylactics or correct child guidance the psychologist and clinician have devoted their energy. When the anthropologist has enlarged his understanding to include progress in physical development as well as progress in physical growth he will have before him an opportunity for responsible constructive effort in an unexplored field which provides a career of usefulness and of immense social significance for, as Dr. Cyril Norwood claimed in a recent address, the first qualification of our children for citizenship is health and physical fitness, a body that can be trusted to do what the will commands.

SUMMARY

(1) The adult physical pattern is the outcome of growth, along lines determined by heredity but enhanced, dwarfed, warped or mutilated in its expression by the influence of environment in the adventures of life.

(2) Of all parts of the body the face appears to be specially sensitive to disturbances of growth. It is particularly in transverse and antero-posterior facial dimensions that we must look for the defects following malnutrition in infancy and early childhood.

(3) Studies of growth in the several children comprising the family indicates that whereas most members tend to pursue a common course of developmental growth statistically expressed as regression towards the mean, marginal members occur as examples of intensified family characters.

(4) Long term quantitative studies on child growth by families promises data of real social significance.

(5) In such studies the record of development or progressive maturation is even more important than the record of dimensional increase.

(6) The serial study of developmental growth offers a new field of endeavor to the anthropologist, with practical applications of great value in eugenics, in physical and scholastic education and in clinical medicine.

OBITUARY

GOTTHELF CARL HUBER

THE passing of Christmas Day, 1934, saw also the passing of Gotthelf Carl Huber, M.D., D.Sc., professor of anatomy in the University of Michigan, director of the anatomical laboratory and dean of the Graduate School. He had been ill for several months, but characteristically carried the full burden of his duties up to within a few days of his death.

Dr. Huber was the son of a Swiss missionary and was born at Hoobly, India, on August 30, 1865. His parents soon removed to the United States and eventually settled at Batavia, N. Y., the boy receiving his early training in American schools. Electing to study medicine, he entered the University of Michigan at a time when Dean Vaughan was building up a new and progressive faculty. It was a constructive period and so appealed to Huber, ever ready to help on any movement, provided it were constructive. So, after graduation in 1887 he began his long term of nearly fifty years of service with the university as assistant in histology under Dr. W. H. Howell, there being at that time no place for either histology or embryology in the department of anatomy. Howell was then carrying on his studies of nerve regeneration and Huber assisted him in this work as well as in the routine classes, learning histological technique, of which he later became such a consummate master. In the succeeding years he found opportunity to visit Berlin (1890, 1891) and Prague (1895), gaining further experience in histological technique.

When Howell resigned in 1892 to accept the chair of physiology at Harvard the courses in histology and embryology fell entirely into Huber's hands and he was appointed assistant professor of these subjects and passed in due course through the grades leading to the full professorship, presiding, with success, over the courses in these subjects for forty-seven years, interrupted only by a year's leave of absence which was spent at the Wistar Institute of Anatomy in a thorough study of the embryology of the white rat. In 1914 he was appointed professor of anatomy and director of the anatomical laboratory, the courses in histology and embryology still belonging to his jurisdiction and thus recognized as parts of the anatomical discipline. In 1928 there was added to his other duties the responsible and influential deanship of the Graduate School and to this he gave freely of his time and experience.

Huber was an indefatigable worker, and even when overburdened with collegiate duties found time to carry out some valuable pieces of investigation. He mastered the more or less elusive methylene blue technique and used it in a study of nerve endings and muscle spindles and he wrote a useful review of our knowledge of the sympathetic system, unraveling its complexities and establishing a new *status a quo*. He then turned his attention to the development of the urinary tubule, upon which subject one is tempted to say that he has written the last word. Of briefer articles mention may be made of that on the fate of the anterior end of the notochord, of that on the blood-vessels of the kidney and of that on the seminiferous tubule, all of which are contributions to our knowledge. During the Great War Huber served as contract surgeon and returned for a time to the study of nerve regeneration and in recent years he has been preparing, with his impeccable technique, series of sections for a thorough comparative study of the vertebrate brain, some results of which have already appeared and others are in press. Huber also edited a translation of the "Textbook of Histology" by Böhm and Davidoff, producing a book especially useful on account of its technical advice.

Huber was a member of many scientific societies, chief among which was the American Association of Anatomists, of which he was secretary from 1902 to 1913, passing then to the presidency (1914–1915). Closely related to this service was his interest in the *American Journal of Anatomy,* of which he was a co-editor from 1901 to 1920 and especially in the *Anatomical Record,* of which he was managing editor from 1909 to 1920. Of other societies of which he was a member mention may be made of the American Physiological Society, the American Association of Pathologists and Bacteriologists, the Society of Experimental Biology and Medicine, the Harvey Society, the American Philosophical Society of Philadelphia and of the Philadelphia Academy of Natural Sciences, these testifying sufficiently to the breadth of his interests and to a wide recognition of his worth. When the Advisory Board of the Wistar Institute of Anatomy and Biology was established Huber was chosen as a member and year after year was an attendant at its annual meetings. He was also an original member of the responsible Medical Fellowship Board of the National Research Council and had been chairman of the board since 1927. Northwestern University in 1930 granted him the degree of D.Sc. honoris causa, and his colleagues of the University of Michigan by appointing him to the Russell lectureship for the current year have testified to his service in maintaining and improving the academic standing of the university.

Not the least of Huber's contacts was his membership in the Alumni Association of his alma mater. He was closely associated with the organization of the

association in 1898 and from that date onward served continuously on its board of directors.

Huber was a genial soul; he enjoyed meeting old friends and making new ones at the Christmas and Easter meetings, and to his friends his outstanding character seemed to be kind-heartedness; he was ever ready with help in trouble or distress. On the academic side the motive force was work; he early discovered for himself that that was the master word.

J. PLAYFAIR MCMURRICH

RECENT DEATHS

DR. MICHAEL IDVORSKY PUPIN, emeritus professor of electromechanics at Columbia University, died on March 12 in his seventy-seventh year.

DR. WILLIAM DUANE, emeritus professor of biophysics at Harvard University, died on March 7 at the age of sixty-three years.

DR. FRANKLIN H. MARTIN, director general and founder of the American College of Surgeons in Chicago, died on March 7. He was seventy-seven years of age.

CHARLES DENISON HOLMES, the inventor, who recently received thanks from President Roosevelt on behalf of the government for his work on marine interna' combustion engines during the war, died on February 28.

PROFESSOR J. MACMILLAN BROWN, chancellor of the University of New Zealand, professor of English literature and an authority on ethnology, died on January 18 at the age of eighty-nine years.

SCIENTIFIC EVENTS

ETHNOGRAPHICAL FILMS

Nature reports that the trustees of the British Museum have accepted the donation of a cinematograph film of the life of the Worora tribe of the Kimberley district of northwest Australia. The film was presented by H. R. Balfour, of Melbourne. It was taken on the Government Native Reserve of Kunmunya, and shows the present conditions of native life. Technological processes, such as the making of stone axes and spear heads, in which these people are specially skilled, the making of fire by twirling one stick on another, the spinning of human hair for thread and the like are shown as living crafts. The "shots" also include ceremonies and dances and an emu corroboree. The film has already been shown to missionaries, learned societies and medical students in Australia; but, as is explained by Sir George Hill in a letter to the London *Times* of February 7, owing to the fact that it was taken on a government reserve, under the regulations of the Commonwealth Government, it can not be shown commercially. With the permission of the trustees of the museum, arrangements have been made for the film to be shown at a meeting of the Royal Anthropological Institute to be held on March 19 at the London School of Hygiene and Tropical Medicine. A description of the film has been supplied by the Rev. J. R. B. Love, who is superintendent of the reserve and is well acquainted with the language of the Worora.

It is further stated in *Nature* that the possibility of forming such a collection or repository was one of a number of points connected with the making, selection and preservation of cinematograph films of anthropological and ethnographical interest, which was referred to a special committee appointed by the recent International Congress of Anthropological Sciences held in London in August last. The committee is international in its composition, Great Britain being represented by Captain T. A. Joyce, of the British Museum. It is announced in the February issue of *Man* that the British Film Institute has established a Scientific Research Panel of its Advisory Council, of which Professor J. L. Myres will act as chairman, to collect information as to the extent to which the cinematograph has been used in scientific work, details of methods and difficulties in technique, and particulars of films of scientific interest which have not been put into circulation through the ordinary commercial channels. The panel will welcome information on any of these points; communications should be addressed to the Secretary, British Film Institute, 4 Great Russell Street, London, W. 1.

ANNIVERSARY OF THE BLUE HILL OBSERVATORY

A CELEBRATION of the fiftieth anniversary of the first regular observation made at the Blue Hill Meteorological Observatory, Harvard University, was held on February 1 by members and ex-members of the staff and guests from the Harvard College Observatory, the U. S. Weather Bureau and the Massachusetts Institute of Technology.

After an inspection of the building, the group met in the radio room on the top floor of the tower, where they heard the hourly automatic tone signal, the strength of which is noted at Mt. Washington and Seabrook Beach, N. H., and at West Hartford, Connecticut. A. E. Bent, in charge of the radio station at Blue Hill, then established contact with A. A. McKenzie, in charge of the station on Mt. Washington, and through him talked with Joseph B. Dodge, founder and manager of the Mt. Washington Observatory and observer at the Pinkham Notch station. Next, also through Mt. Washington, contact was

made with Henry S. Shaw, a member of the overseers' committee for Blue Hill, at his home in Exeter, N. H. Dr. Willard P. Gerrish, assistant professor of mechanical engineering at the Harvard Astronomical Observatory, replied to Mr. Shaw's greetings. Mr. Bent summarized briefly the nature of the Blue Hill radio equipment—including both 5-meter and 2½-meter sending and receiving sets—used in experimenting with transmission over distances which approach the limits possible with such equipment.

Dr. Gerrish, first observer at the Blue Hill Station, H. Helm Clayton and S. P. Fergusson, members of the staff during the early days of the observatory, described its opening. Letters were read from Dr. Alexander McAdie, director emeritus, who is now in Virginia; L. A. Wells, a former member of the staff; Dr. Oliver L. Fassig, research associate, who is now conducting studies in Puerto Rico; Dr. H. H. Kimball, research associate; Dr. S. S. Drury and John Woodbury, members of the Harvard Overseers' Committee on Blue Hill.

Dr. Harlow Shapley, director and Paine professor of practical astronomy at the Harvard Observatory, gave a summary of meteorology in relation to the astronomical observatory, and G. H. Noyes spoke as a representative of the U. S. Weather Bureau. In conclusion, Dr. Charles F. Brooks, director at Blue Hill, outlined some phases of the work now being done at the observatory and the possibilities for future studies.

THE YALE NORTH INDIA EXPEDITION

PLANS for the second North India Expedition, which will investigate the background of primitive man under the leadership of Dr. Hellmut de Terra, of Yale University, have been made public. The expedition will carry on its investigations under the auspices of Yale University, the Carnegie Institution of Washington, the American Philosophical Society, the Geological Survey of India and the Cenozoic Research Laboratory in Peking, China.

Dr. de Terra, who was the leader of the first expedition and goes into the Himalayas now for the third time, was geologist of the German Central Asia Expedition in 1927–28, the following year serving as curator in the Museum of Natural History in Berlin. He went to Yale University in 1930 and is research associate in Peabody Museum.

Dr. de Terra, accompanied by Mrs. de Terra, who will take part in the field work, sailed from New York on February 2. They will be joined in India by Père Teilhard de Chardin, acting director of the Cenozoic Research Laboratory, who is paleontologist of the present expedition, and by V. N. Ayengar, paleontological collector of the Survey of India. It is expected that several British institutions will be jointly represented by T. T. Patterson, of the University of Cambridge, who will cooperate in the fields of geology and archeology. M. de Chardin has carried on research in China, having assisted in the paleontological investigation that led to the discovery of the Peking man. Dr. Ayengar has spent several seasons in the Himalayas collecting fossils buried in ancient geologic formations.

The expedition, which will confine its field to the Southern Himalayas, will begin its work in the Salt Range, which is one of the smaller mountain ranges of northern India, and lies some eighty miles south of the Himalayas. It will reach Kashmir at the beginning of the summer and by autumn will commence research in Himalayan foot hills. The circuit to the Salt Range will be completed the following winter. The background of early mankind will be investigated from the paleontological, geological and archeological standpoints.

The first expedition, which spent more than a year in this region, brought back information of the youthful character of the mountains. George E. Lewis, of Yale University, paleontologist of the first expedition, collected a large number of fossils, including ten fragmentary remains of man-like apes, of which one is said to be regarded as the most human-like fossil ape so far recorded. In addition to this new information on the evolution of man, Dr. de Terra found several sites of artifacts dating back to the Old Stone Age, which indicate that early man inhabited the Himalayan foothills. The biologist of the first expedition, Professor G. Evelyn Hutchinson, also of Yale University, collected data on the distribution and adaptation of fresh-water life to high altitudes. The remains of hitherto unknown specimens of man-like apes which were discovered consisted of five fossil jaws, each retaining two or more teeth, as well as several individual teeth. Later study revealed the presence of a new species belonging to a known genus, and three new genera, two of which probably represent, more than any other genus yet uncovered, a much closer approximation to the main trunk.

THE COMING MINNEAPOLIS MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

PREPARATIONS for the summer meeting at Minneapolis are progressing well. Arrangements have been concluded for joint sessions between the Minnesota State Medical Society, which is meeting at the same time in Minneapolis on Monday and Tuesday, and the association which extends its program to include the week from June 24 to June 29. A goodly number of affiliated societies are meeting with the association at various times during the week. Headquarters for the association have been set for the Hotel Nicollet. This is in the business section easily accessible

to the various railroad stations. Hotel facilities are abundant and reasonable in price. The meetings will be held on the new campus of the University of Minnesota. The splendid lecture hall of the Northrup Auditorium will be used for the evening general sessions.

Several prominent scientists have been secured for the addresses at these sessions, but the exact dates are not yet adjusted. The various biological sections and affiliated societies are planning extensive programs with emphasis upon the relations of biological sciences to medicine as naturally associated with the meeting of the Minneapolis State Medical Society at the same time. Similar emphasis is being laid upon the important relations of various fields in pure and applied science to prominent questions of land planning, soil erosion, stream control and utilization, and other features intimately related to Minnesota and the adjacent regions.

In accordance with the general plan which has operated successfully in recent summer meetings, programs are being primarily devoted to symposia, discussions of significant regional problems and joint sessions between sections. The afternoon is left open for field work, round tables, informal conferences and social gatherings. Some unusual opportunities will be given for seeing striking features of the region and for longer trips at the close of the sessions. Members of various sections desirous of presenting papers or participating in discussions will communicate with section secretaries, who will see that requests are properly forwarded. In accordance with previous custom it is not expected that section secretaries should attend and be responsible for programs of two meetings within the year. Unexpected complications prevent the publication at this time of the list of acting secretaries who will serve the various sections for the Minneapolis meeting. Communications may also be sent through the office of the permanent secretary, Smithsonian Institution Building, Washington, D. C.

Railroad rates, while not yet officially announced, will be favorable as usual. Those residing at a distance will probably find summer excursion rates most advantageous. Further announcements on this and other points will appear in later issues of SCIENCE. The preliminary program will be printed as usual the last of May.

HENRY B. WARD,
Permanent Secretary

IN COMMEMORATION OF DR. G. CARL HUBER AND DR. DAVID WHITE

IN commemoration of the association with the National Research Council of Dr. G. Carl Huber, of the University of Michigan, and of Dr. David White, of the U. S. Geological Survey, extending over many years, the administrative committee of the council adopted the following resolutions at its meeting in Washington, D. C., on February 16:

WHEREAS, the National Research Council has learned with deep regret of the death of Doctor G. Carl Huber, professor of anatomy, director of the Anatomical Laboratories, and dean of the Graduate School of the University of Michigan, and a member of the faculty of the University since 1887; and

WHEREAS, the National Research Council recalls with full appreciation the high value of the services which Dr. Huber has generously given to the administration of the fellowships of the Medical Fellowship Board of the council; and

WHEREAS, the National Research Council recognizes the many contributions which Dr. Huber has made to medicine and to medical education in the United States, it is

Resolved, that the National Research Council records its high esteem for Dr. Huber and extends its sympathy to the members of his family, and directs that a copy of this resolution be sent to Dr. Huber's family.

WHEREAS, the National Research Council has learned with deep regret of the death of Dr. David White, special scientist in the United States Geological Survey and a member of the survey since 1886; and

WHEREAS, Dr. White has been constantly associated with the National Research Council since 1919, as a member of the Executive Board of the Council and through the council's Division of Geology and Geography in which he served as a member for many years and as chairman of the Division from 1924 to 1927 and as a member of committees of the Division; and

WHEREAS, the National Research Council is greatly indebted to Dr. White for sound advice and unfailing support during these years, it is

Resolved, that the National Research Council places on record its recognition of the especially meritorious services which Dr. White has rendered in carrying out the purposes for which the council was established, in advancing the science of geology, and in stimulating research in other fields of science as well, and that the council extends its sympathy and directs that a copy of this resolution be transmitted to Dr. White's family.

SCIENTIFIC NOTES AND NEWS

THE council of the Royal Society, London, has recommended for election into the society seventeen candidates, as follows: N. K. Adam, research chemist, University College, London; E. N. da C. Andrade, Quain professor of physics, University of London; Sir Frederick G. Banting, professor of medical research, University of Toronto; S. P. Bedson, professor of bacteriology, London Hospital; E. J. Bowen,

fellow of University College, University of Oxford; G. E. Briggs, lecturer in plant physiology, University of Cambridge; H. G. Cannon, professor of zoology, University of Manchester; W. E. le Gros Clark, professor of anatomy, University of Oxford; J. S. Foster, professor of physics, McGill University; A. L. Hall, lately assistant director of the Geological Survey of the Union of South Africa; W. H. Hatfield, Brown-Firth Research Laboratory, Sheffield; J. de Graaff Hunter, lately of the Survey of India; B. A. Keen, Rothamsted Experimental Station; R. A. Peters, Whitley professor of biochemistry, University of Oxford; J. Read, professor of chemistry, University of St. Andrews; R. N. Salaman, director of the Potato Virus Research Station, Cambridge, and R. Stoneley, lecturer in mathematics, University of Cambridge.

WE learn from *Nature* that the following have recently been elected foreign members of the Royal Academy of Sciences, Stockholm: Dr. Robert Robinson, professor of chemistry in the University of Oxford; Dr. Frank D. Adams, emeritus Logan professor of geology in McGill University; Dr. Ejnar Hertzsprung, professor of astrophysics in the University of Leyden, Holland; and Dr. A. V. Hill, Foulerton research professor of the Royal Society, formerly Jodrell professor of physiology in University College, London.

THE George W. Carpenter Prize of the Academy of Natural Sciences of Philadelphia, awarded each year for the best piece of original scientific research, was presented at the annual meeting to Dr. Henry A. Pilsbry, curator of mollusca. In addition to a cash prize, the award carries with it the publication of the research work of the recipient, which in this case will consist of a study of land mollusca of North America.

BRONZE medals and citations were conferred by Rutgers University on March 1 on Dr. Walter T. Marvin, dean of the College of Arts and Sciences, "for able and devoted service" and on Dr. Thomas J. Headlee, professor of entomology and entomologist at the New Jersey Agricultural Experiment Station, "as a valued servant of the university and the state."

THE award of the Charles A. Coffin Foundation, the highest honor which the General Electric Company can bestow upon an employee, was made on March 1 to August Kayser, a tool designer at the company's plant at Fort Wayne, who has been with the company forty-four years. The award was given to Mr. Kayser for ingenuity in designing, building and making improvements in special automatic machines.

HARVARD UNIVERSITY has announced the following changes: The resignation of Dr. Alice Hamilton, assistant professor of industrial medicine at the Harvard Medical School since 1919, to take effect on September 1; the promotion of Dr. Joseph Leonard Walsh to a professorship of mathematics, and the election of Hassler Whitney to an assistant professorship of mathematics and of John Gilbert Beebe-Center to a lectureship in psychology.

DR. LILLIAN MOLLER GILBRETH, consulting engineer, has been appointed professor of management at Purdue University, the appointment to become effective next September.

DR. ARTUR HAAS, professor of physics at the University of Vienna, has been invited to serve as visiting professor of physics next year at the Drexel Institute of Philadelphia. He delivered a lecture at the institute on February 26.

THE Natural History Museum of San Diego, California, has announced the addition to its staff on February 1 of Adriaan J. van Rossem, formerly research fellow in the department of vertebrate zoology at the California Institute of Technology.

F. A. SILCOX, chief forester, has announced the following reassignments in the research organization of the Forest Service of the U. S. Department of Agriculture: C. L. Forsling, director of the Intermountain Forest and Range Experiment Station at Ogden, Utah, will become director of the Appalachian Forest Experiment Station, with headquarters at Asheville, N. C.; E. H. Frothingham, who has served as director of the Appalachian Station since its organization in 1920, has, at his own request, been relieved of the directorship so that he may concentrate his efforts on silvicultural research; Dr. Reed W. Bailey, associate professor of geology at Utah State Agricultural College, who for the past year has been serving as conservationist at the Intermountain Station while on leave from the college, will become director of the station, with headquarters at Ogden.

L. J. GRAHAM and F. E. James, of the department of agricultural and biological chemistry, Pennsylvania State College, have accepted research positions with the G. W. Carnrick Company, of Newark, N. J., and the Ralston Purina Company, of St. Louis, Mo., respectively.

GEORGE H. FANCHER has resigned as assistant professor of petroleum and natural gas engineering at the Pennsylvania State College to accept a position with the York State Oil Company, of Caney, Kansas.

DR. PAUL C. KITCHEN, assistant professor of histological and clinical dentistry at the Ohio State University, has been named assistant editor of *The Journal of Dental Research*, published by the International Association for Dental Research. He is also

secretary of the program committee on research of the American Dental Association.

DR. HAROLD C. UREY, professor of chemistry at Columbia University, Nobel prize laureate for 1934, returned on March 9 from England and Scandinavia.

DR. CARL L. HUBBS, curator of fishes at the museum of zoology and director of the Institute for Fisheries Research of the University of Michigan, and Dr. Henry van der Schalie, assistant curator of the division of mollusks, started during the last week of January on the fourth university expedition into Central America under the auspices of the Carnegie Institution at Washington. They will search for rare species of fish and mollusks in the region near Lake Petin, Guatemala.

DR. ROBERT K. ENDERS, assistant professor of zoology at Swarthmore College, has returned from Panama, where he conducted research on animal behavior and collected several rare specimens of monkeys and sloths. He expects to return to the Barro Colorado Island laboratory of the Institute for Research in Tropical America in the near future for further research.

HENRY FIELD, a member of the staff of the Field Museum of Natural History, Chicago, has invited the Soviet Academy of Science to cooperate in an expedition for anthropological research among the peoples of the Caucasus.

DR. CHARLES A. SHULL, professor of plant physiology at the University of Chicago, will lecture before the Graduate College at the University of Iowa on March 25, on "Radiation and Life." He will also give an address before the botany seminar on "Plant Carotinoids."

ON February 28 and March 1, Dr. William Crocker, managing director of the Boyce Thompson Institute for Plant Research, lectured before the division of biology of the Canadian National Research Council at Ottawa, Canada, on "The Effect of Light and Unsaturated Carbon-Containing Gases on Plants" and on "Delayed or Distributed Germination of Seeds."

DR. ALEXANDER SILVERMAN, head of the department of chemistry in the University of Pittsburgh, addressed the members of the Franklin Institute in Philadelphia on February 7 on "Glass: An Indispensable Factor in Modern Civilization."

DR. ALFRED C. LANE, professor of geology at Tufts College and chairman of the committee on the determination of geologic time of the National Research Council, delivered a lecture at Bryn Mawr College on February 22 on "The Age of the Earth." On February 23 he spoke before the department of geology on "Correlation of the Pre-Cambrian Rocks."

DR. ERNEST CARROLL FAUST, professor of parasitology, Tulane University School of Medicine, addressed the Sigma Xi Club of the University of Georgia on January 18. His subject was "Some Biological Aspects of Public Health Problems in the South."

DR. JOHN R. MURLIN, professor of physiology and director of the department of vital economics in the University of Rochester Medical School, gave the annual address before the Michigan State College chapter of the Sigma Xi on February 6. His subject was "Recent Developments in the Study of Energy Metabolism of the Human Body." He also spoke at a faculty club luncheon on "A Physiological Conspiracy."

DR. EDGAR T. WHERRY, associate professor of botany at the University of Pennsylvania and ecologist of the Morris Arboretum, lectured before the Muhlenburg Botanical Club at Lancaster, Pennsylvania, on March 6.

DR. OLAF ANDERSEN, of the U. S. Steel Research Laboratory, Kearney, N. J., formerly of the Geophysical Laboratory of the Carnegie Institution of Washington, completed in January before the department of geology, Princeton University, a series of nine lecturers on "Phase Equilibrium Diagrams of the Refractory Oxides; Their Interpretation and Application to Slags, Refractories and Igneous Rocks."

CHARLES A. EDWARDS, principal of the University College of Swansea, Wales, addressed the Washington Academy of Sciences on March 8. His subject was "Science, Education and Industry: Whither Drifting?"

A SERIES of six public lectures on aerophotography is being given at the institute of geographical exploration, Harvard University. The first in the series, on February 6, by Captain Albert W. Stevens, was entitled "The National Geographic-Army Air Corps Stratosphere Flight of 1934." The other lecturers are: Captain B. C. Hill, on February 20; Lieutenant J. F. Phillips, on April 24, and Captain D. M. Reeves, on May 1.

THE Society of Sigma Xi of the University of California has announced the following illustrated lectures to be delivered under the auspices of the chapter: February 20, Dr. W. H. Kellogg, chief of the bureau of laboratories, State Department of Public Health, "The Black Death in Modern Times"; March 6, Professor Joel Stebbins, director of the Washburn Observatory, University of Wisconsin, "The Dark Galaxy"; March 27, Dr. C. E. ZoBell, of the Scripps Institution of Oceanography, "The Occurrence and Significance of Bacteria in the Sea"; April 10, Dr. H. S. Smith, entomologist of the Citrus

Experiment Station, Riverside, "Adaptations to the Parasitic Life in Insects"; May 1, Dr. Ralph W. Chaney, professor of paleontology, University of California, "Forest Migrations Around the Pacific"; May 22, Dr. P. H. M.-P. Brinton, research chemist and visiting professor of chemistry at the University of Southern California, "The Work of the Chemist in the Detection of Crime."

THE American Institute has announced the following lectures: March 12, "Biological Effects of Radiation of Various Wave Lengths," by Dr. Ellice McDonald, director of cancer research at the University of Pennsylvania, with Dr. Hugh S. Taylor, director of the Frick Chemical Laboratory of Princeton University, as guest authority; March 19, "Modern Fermentation Processes and Products," by Dr. Charles N. Frey, director of the Fleischmann Laboratories, with Dr. John A. W. Hartung, chief chemist of the Jacob Ruppert Brewing Company, as guest authority; March 25, "Recent Advances in the Treatment and Management of Chronic Arthritis," by Dr. William Bryant Rawls, lecturer in medicine at the New York Polyclinic Medical School, with Dr. Russell L. Cecil, clinical professor of medicine at Cornell University, as guest authority.

THE annual meeting of the Alabama Academy of Science will be held on April 12 and 13 at the State Teachers College at Florence, Ala., which is situated in the Muscle Shoals district. Titles for papers to be read at the meeting should be sent to the secretary, P. H. Yancey, Spring Hill College, Mobile, Ala., not later than March 20.

THE eleventh scientific session of the American Heart Association will be held on Tuesday, June 11, from 9:30 to 5:30 P.M. at the Hotel Claridge, Atlantic City, N. J. The program will be devoted to various subjects on cardiovascular disease.

THE committee on scientific research of the American Medical Association invites applications for grants of money to aid in research on problems bearing more or less directly on clinical medicine. Preference is given to requests for moderate amounts to meet specific needs. Application forms can be obtained from the committee at 535 North Dearborn Street, Chicago, Illinois.

THE New Hampshire Forestry Department announces that applications for research fellowships in forestry and allied subjects should be made to the Caroline A. Fox Research and Demonstration Forest, Hillsboro, N. H., not later than April 15. The fellowships are open to men and women who have completed three years' work, not necessarily in forestry, in a college of recognized standing. Projects may be undertaken in fields allied to forestry, such as botany, zoology, soil science, climatology, economics and sociology. Appointments, which ordinarily carry a stipend of $150, are for one year from June 1. Appointees must be in residence at Hillsboro and in the field in New Hampshire for a minimum of two months.

FORMAL approval has been given by the board of supervisors of Louisiana State University to the establishment of schools of dentistry and pharmacy in the division of medical instruction. The division is to be known as The Louisiana State University Medical Center. Pending erection of a new building on the Charity Hospital grounds in New Orleans, the two schools will be housed in the main building of the center. Applications for enrolment are now being accepted.

DISCUSSION

BACKGROUND AND ORIGIN OF THE AMERICAN ASSOCIATION

THOSE who are interested in the history of American science and in the organization of scientific men will find in the most recent volume of "Summarized Proceedings" of the American Association for the Advancement of Science (for 1929–1934) a short but unusually interesting and valuable historical chapter contributed by Austin H. Clark and Leila Forbes Clark. A short review of that chapter for the readers of SCIENCE seems worth while. Beginning with a sketch of the status of science in the American colonies of England and in the mother country, about the middle of the seventeenth century, the authors point out that freedom of thought and action was at that time greater in the colonies and that there consequently arose an embryo plan, according to which some of the leaders of British science (Boyle and others) were to join John Winthrop the younger in New England, there to establish a "Society for the Promotion of Natural Knowledge." The proposed emigration did not occur, however, and the Royal Society, chartered by King Charles II in 1662, published in its *Transactions* most of the records of American research for over a century.

Under the leadership of Benjamin Franklin an "American Philosophical Society" was started about 1743, but its life was short. Another organization, "The American Society for Promoting and Propagating Useful Knowledge held in Philadelphia," was formed in 1766, with Benjamin Franklin president, and two years later its title was changed to "The American Society held at Philadelphia for Promoting Useful Knowledge." A new "American Philosophical

Society" had been formed in the meantime and these two became merged in 1769, after prolonged negotiations, with a new name that has since become familiar, "The American Philosophical Society held at Philadelphia for Promoting Useful Knowledge."

The well-known "American Academy of Arts and Sciences," established in Boston, was incorporated in 1780. The "Academy of Arts and Sciences of the United States of America" was started about 1788 in Richmond, Virginia, but did not thrive very long.

In the presidential administration (1801–1809) of Thomas Jefferson, who was prominent in the American Philosophical Society and was in touch with the intellectual life of his period, was established the United States Corps of Engineers, which was a nucleus for the "United States Military Philosophical Society." The latter, which was apparently the first truly national American scientific society, died soon after 1810. The "Columbian Institute for the Promotion of Arts and Sciences," incorporated by Congress in 1818, soon passed into the "National Institution for the Promotion of Science," organized in 1840. That institution arranged a national congress of scientific men, held in Washington in April, 1844, to which were invited all other American scientific organizations and all individuals interested in the advancement of knowledge, but no other meetings of that kind were held and the National Institution finally went out of existence in 1861.

Under the leadership of Dr. John Collins Warren, a Boston group urged the desirability of forming an American association after the pattern of the British Association for the Advancement of Science, but they referred their proposal to the American Philosophical Society and received a discouraging reply in April, 1839. Meanwhile, the "Association of American Geologists" had been organized. It held its first and second meetings at Philadelphia (1840, 1841) and its name was changed to "The Association of American Geologists and Naturalists" at its third meeting, held at Boston in 1842. The last meeting of this organization occurred in 1847, also in Boston. At that meeting, in which Dr. Warren took part, it was voted that the "Association of American Geologists and Naturalists" should resolve itself into the "American Association for the Promotion of Science" and it was arranged that the resulting enlarged association should hold its first meeting at Philadelphia the following year. At the first session of that first meeting, on September 20, 1848, the name of the organization was changed to the "American Association for the Advancement of Science," and William C. Redfield was elected and installed in the afternoon of the same day, as the first president of the association. The association was incorporated by act of the Senate and House of Representatives of the Commonwealth of Massachusetts in March, 1874.

An account of the history of the American Association, by Dr. Herman W. Fairchild, presented at the seventy-fifth anniversary meeting, at Cincinnati, in December, 1923, was published in SCIENCE, Volume 59, 1924.

Besides the chapter on background and origin, this last volume of Summarized Proceedings contains much interesting information about the recent activities of the association. A graph shows that the paid-up membership increased rather steadily from 10,002 in 1920 to 18,269 in 1931, after which it decreased to only 15,728 in 1933, but it increased to 16,429 in 1934. The volume reports annual meetings held at Des Moines, Cleveland, New Orleans, Atlantic City and Boston, and the intervening summer meetings, with the usual lists of officers and references to notes and addresses that were published in SCIENCE. It contains the complete list of sustaining and life members and the very useful Directory of Fellows and other Members, corrected to June, 1934.

For the first time, the value and usefulness of the directory are greatly enhanced by the addition of an 82-page geographical index, which shows the section enrolment of every member. By means of this index, it is easy to ascertain exactly which members reside in any locality and to classify them according to the branches of science in which they are engaged.

Copies of the book may be obtained from the office of the American Association, Smithsonian Institution Building, Washington, D. C., the postpaid prices being $3.00 (cloth binding) or $2.50 (paper cover) to those whose names occur in the directory, and $4.00 or $5.00 to others.

BURTON E. LIVINGSTON

REMARKS ON SULAIMAN'S THEORY OF RELATIVITY

IN view of the interest aroused in Sir Shah Sulaiman's new theory of relativity[1] by Professor Shapley's characterization of it in SCIENCE for November 16, 1934, as one of the "high-lights of astronomy during the past year," the following considerations may be of interest.

Sulaiman bases his theory of gravitation on "gravitons," fine particles "at present beyond the range of our perceptions." It appears, from the brief statement in his first paper, that this hypothesis is essentially the same as that put forward by LeSage in 1764 as an explanation of gravitation.[2] Also, both

[1] *Proc. Acad. of Sciences, U. P., India,* Vol. 4, Part 1, pp. 1–36, 1934.

[2] Cf. *Enc. d. Math. Wiss.,* Band V–1, pp. 57–64 or, more briefly, Lorentz, *Lect. on Theor. Phys.,* vol. 1, pp. 151–155.

theories lead to a shifting forward of the direction of attraction between two relatively moving bodies, a phenomenon exactly analogous to the aberration of light.

The effect of this aberration on the planetary orbits was first discussed by Laplace. He found that the resulting tangential acceleration of the planets had no effect on the longitude of perihelion, but introduced secular perturbations in the semi-major axis and eccentricity of the orbit and in the mean longitude of the planet in the orbit.

According to Jenneck,[3] calculations based upon Laplace's theory and upon the unexplained secular variations of the semi-major axis of the moon's orbit give as the lower limit of possible values for the velocity of propagation of gravitation about 10^8 times the velocity of light. Chazy[4] makes the following statement:

> Si l'on admet comme résultat des observations que l'accroissement séculaire de la longitude ne peut dépasser 2″ pour la Terre et 0.5″ pour Mercure, et si l'on cherche à expliquer par l'hypothèse précédente [Laplace's hypothesis] une accélération de la Lune de 2″ au plus par siècle, on obtient trois limites inférieures de la vitesse V_1 [velocity of propagation of gravitation] voisines respectivement de 6 millions, 600 millions et 30 millions de fois la vitesse de la lumière.

Sulaiman introduces, in effect, a slight modification of Laplace's theory in changing the magnitude of the attracting force (which Laplace kept unchanged from the Newtonian law) by the factor $\left(1-\frac{v}{D}\right)^3$, v being the radial velocity and D the velocity of propagation of gravitation, assumed by Sulaiman to be nearly equal to the velocity of light. The net result of this change is to introduce an advance of the perihelion close to the desired value in the case of Mercury. However, nothing is accomplished toward removing the objectionably large secular perturbations of Laplace's theory; on the contrary, the perturbation of the eccentricity is doubled.

To be specific with regard to this last point, calculations based upon Sulaiman's formulae (calculations which he apparently has not carried out) give for the secular logarithmic perturbations, in one earth year, of the semi-major axis and eccentricity, respectively, of Mercury's orbit the values .009643 and .01275. Tisserand,[5] quoting Newcomb's "Fundamental Constants of Astronomy," gives in the case of the eccentricity the discrepancy between Newtonian theory and observation (reduced here to a period of one year) as $(-4.3 \pm 2.5) \times 10^{-8}$—of opposite sign from the change predicted by Sulaiman's formula. In the case of the eccentricity of Venus, Earth and Mars, Newcomb and Sulaiman agree as regards sign; but to bring the values calculated from Sulaiman's formula into agreement with Newcomb's figures, it is necessary in using Sulaiman's formula to give D values ranging from 6×10^4 times the velocity of light (Mars) to 2×10^6 in the case of the earth.

The absurd size of Sulaiman's perturbations may be realized from the fact that the above calculated perturbation in Mercury's eccentricity is equivalent to an absolute yearly increase of .0026 in the eccentricity. As the eccentricity increases this of course does not remain constant; but taking it as a constant for the sake of illustration, Mercury's eccentricity would in 300 years reach unity and the planet would go off in a parabolic orbit!

Sulaiman's theory, in so far as it relates to gravitation, would seem, then, to founder on the same rock as Laplace's mathematically analogous theory and the modified forms of LeSage's physically similar theory. Neither are valid unless to the velocity of propagation of gravitation is assigned enormous values from 10^5 to 10^8 that of light; and aside from the objections to this, if this is done in Sulaiman's case, the desired advance of the perihelion is reduced to a negligible value and the theory accomplishes nothing in gravitational phenomena.

I take this opportunity to make acknowledgment of my indebtedness to Professor H. P. Robertson, of Princeton University, who suggested this investigation and gave valuable assistance in the pursuit of it.

D. R. HAMILTON

PALMER PHYSICAL LABORATORY
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[3] *Enc. d. Math. Wiss.*, Band V–1, p. 49.
[4] Chazy, "La Théorie de la Relativité," vol. 2, p. 134.
[5] Tisserand, "Mécanique Celeste," vol. 4, p. 535.

LAST CALL FOR CULTURE METHODS

THE committee of American zoologists, commissioned to compile and issue a compendium of culture methods for invertebrate animals, desires to express its appreciation of the cordial cooperation already received and to issue a last call for further contributions.

The committee met in Pittsburgh on December 26 and went over the large number of valuable manuscripts already received, making note of others promised and of the many gaps still remaining. The month of June, 1935, has been set as the latest date for the receipt of further contributions. It is the hope of the committee that the volume containing these contributions may be ready for the printer in September.

The committee is receiving articles on culture methods and lesser notes on the "tricks of the trade" from those who have had experience. These will be as-

sembled for publication over their authors' signatures. Conciseness is essential and, as stated in a former notice in these columns,[1] "the committee reserves the right to condense and combine" where necessary.

Any one who has developed or improved methods of culturing invertebrate animals and wishes to assist in making this volume as complete as possible is cordially invited to communicate with the committee's secretary, Miss Mary E. Davis, Comstock Hall, Ithaca, N. Y., or with any member of the committee.

FRANK E. LUTZ
PAUL S. GALTSOFF
PAUL S. WELCH
JAMES G. NEEDHAM, *Chairman.*

CHEMICAL COMPOSITION OF LARGE AQUATIC PLANTS

THE general investigations relating to the productivity of Wisconsin lakes have included studies of the chemical composition of the larger aquatic plants. Since these plants serve as a source of food, not only for strictly aquatic forms such as oligochetes, mollusks, insect larvae and fish but also for such animals as ducks and deer, their food value was regarded as an important item in these chemical studies.

Four papers dealing with the organic as well as the inorganic content of some of the larger aquatics were published by Schuette[1] between 1921 and 1929, which indicated the general food value of the forms that were analyzed. It is interesting to note that the chemical results published by Gortner[2] in a recent number of SCIENCE for the large aquatics of Minnesota lakes are in reasonably close agreement with those obtained by Schuette. The greatest difference is found in the Potamogetons, where the Wisconsin material yielded a somewhat smaller percentage of crude protein and a larger percentage of nitrogen-free extract than that from the Minnesota lakes. Birge and Juday[3] found that the percentage of crude protein varied with the stage of maturity of these plants, while Harper and Daniel[4] noted that the percentage of nitrogen varied with the character of the soil on which they grew; thus these two factors are probably responsible for the more marked differences noted in the Potamogetons.

With respect to the annual yield of large aquatic plants, Rickett[5] estimated the crop in Lake Mendota at 2,000 kilograms per hectare (1,800 pounds per acre), dry weight, in the zone occupied by them and 1,780 kilograms per hectare (1,580 pounds per acre) in Green Lake. Similar studies have been made on a dozen lakes in northern Wisconsin; while a report on this work has not been completed, the data indicate that the crop of large aquatics in them is much smaller, especially in those with soft water.

C. JUDAY
UNIVERSITY OF WISCONSIN

CONCERNING THE TASTE OF HEAVY WATER

IN discussing the recent press reports of the drinking of heavy water by Professor Hansen, of Oslo, the present writers could not account for the "dry burning sensation" said to have been experienced by Professor Hansen—assuming that it had been due to the water. Accordingly, it was decided to make a personal test.

In order to make the experiment as objective as possible, a third person in a different room prepared the samples to be tasted. Each of us was then given two identical watch glasses, one containing one cubic centimeter of ordinary distilled water, and the other the same amount of pure heavy water, especially prepared for biological experiments. One of us kept each sample in his mouth for a short time to make sure of its taste, and then spat it out. The other repeated the same procedure, but swallowed the water. Neither of us could detect the slightest difference between the taste of ordinary distilled water and the taste of pure heavy water. It might be mentioned in this connection that one cubic centimeter of water is not too small an amount to taste properly, since both of us could detect plainly the characteristic "flat" taste of distilled water in both cases. It may be concluded, therefore, that pure deuterium oxide has the same taste as ordinary distilled water.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

THE CHOICE OF KILLING FLUIDS APPROPRIATE FOR CYTOLOGICAL RESEARCH

THE increasing use of cytological investigations by workers in the fields of physiology and pathology indicates that we have reached a point in biology where we are ready to use cytomorphological methods as an important adjunct to the study of function.

One of the writers pointed out a quarter of a cen-

[1] SCIENCE, 77: 427–428, 1933.
[1] *Trans. Wis. Acad. Sci.*, 20: 529–531, 1921; 23: 249–254, 1927; 24: 135–139 and 141–145, 1929.
[2] SCIENCE, 80: 531–533, 1934.
[3] *Wis. Geol. & Nat. Hist. Sur. Bull.*, 64: 215, 1922.
[4] *Bot. Gaz.*, 96: 186–189, 1934.
[5] SCIENCE, 52: 641–642, 1920; *Trans. Wis. Acad. Sci.*, 20: 521–527, 1921; 21: 381–414, 1924.

tury ago that the essential living parts of the cell preserve their fundamental structure so long as the cell survives. The character which does change readily, either due to chromosomic constitution or to the agency of external factors, is the way the cell synthesizes or accumulates non-living constituents. Under favorable conditions a cell provided with the proper genes actively uses up the heterogeneous materials absorbed from the environment to build up homogeneous materials, which appear under the microscope as "optically empty" cytoplasm, mitochondria and "vacuolar sap." Under unfavorable conditions the homogenizing process is inhibited, resulting in the accumulation of unmetabolized products in the form of amino-acids, glucids or phenolic compounds in solution in the vacuolar sap, or as inclusions such as protids or lipids. In other cases, unused glucids accumulate as starch within the plastids.

Starch storage (which is concomitant with the differentiation of more mitochondria into amyloplasts) is correlated with inhibition of respiratory activity and a retarded rate of growth.

The results of modern cytological studies have shown that a living cell is not necessarily a physiological unit. On the contrary, metabolic processes utilizing the energy afforded by respiration probably take place mainly along the interphase between cytoplasm and vacuolar solution, and each of the "respiratory surfaces" within the cell may be differently affected by external stimuli, thereby producing a definite polarization within the living cell.

The total respiratory activity on an organism is the sum of the respiration on which depends the upkeep of the cell activity—maintenance—and of the respiration which provides energy for the syntheses within the growing cell. The former—the maintenance respiration—may proceed, although the latter—the growth-providing respiration—is inhibited by various agencies.

It is almost axiomatic that one who studies cytology should attempt to preserve the actual cell structure as well as possible. When studying cell morphology one should rely on the results of killing and staining methods only when he can check them through the observation of the living cell.

The killing fluid employed should, therefore, preserve as well as possible all constituents that can be seen in the living cell. It is especially important to preserve as much as possible of the apparent homogeneity of the cytoplasm, the clear-cut appearance of mitochondria and plastids, the outlines of the vacuoles and, above all, the products of cell metabolism. These results can be obtained only when the killing fluid penetrates the living tissues rapidly. Meves' fluid, which is admirable for some purposes, penetrates slowly. Tissues should be kept in Meves' for a week. It stains lipid inclusions dark brown and precipitates phenolic compounds as black bodies in the vacuoles, but may produce artifacts of a deceptive nature.

Nemec's killing fluid penetrates quickly, due to its formaldehyde content, and preserves the morphological integrity of the cell.[1] For the best results it requires a subsequent treatment in 3 per cent. potassium bichromate of at least 8 days to mordant the mitochondria and other constituents. Nemec's fluid precipitates phenolic materials as yellow flocculi, the consistency of which depends somewhat upon the concentration of potassium bichromate employed.

If principles like these were followed, investigators would soon cease to discuss the "good" or "poor" killing obtained through the use of mixtures containing acetic acid or alcohol, since they would realize that such mixtures so wreck the cell structure as to make any inferences drawn from the subsequent staining reactions void of significance.

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ON THE MAPPING OF THE VELOCITY-POTENTIAL AND STREAM FUNCTIONS OF AN IDEAL FLUID

THE methods of Hele Shaw[1] and of Osborne Reynolds[2] in showing the form of the stream-lines about an obstacle are well known. Other methods have been developed by Relf[3] for ideal fluids and by Taylor and Sharman[4] for compressible fluids. Both of the two latter methods require rather elaborate set-ups of a more or less permanent nature, involving considerable apparatus. A modification of these methods, used by the writer in 1932–1933 in connection with some aerodynamic testing, proved quite helpful.

Acting upon the suggestion by Grillet[5] that sheets of conducting paper might be used to plot mathematically orthogonal functions, the writer has obtained satisfactory results, using in place of the usual liquid electrolyte an inexpensive black silhouette paper. The experimental procedure was, of course, identically the same as in the laboratory experiment showing equi-

[1] H. S. Reed and J. Dufrenoy, *Amer. Jour. Bot.* In press.

[1] Trans. Inst. Naval Architects, p. 27, 1898; *Comptes Rendus*, 132: 1306–1312, 1901.

[2] *Phil. Trans. Roy. Soc.*, 1883.

[3] *Phil. Mag.*, 48: 535, 1924.

[4] *Proc. Roy. Soc.*, London, A 121: 194–217, 1928.

[5] *Comptes Rendus*, 194: 1464–1465, 1932.

potential lines and lines of flow of current; the earphones and the alternating electric current being, however, replaced by a galvanometer and by direct electric current.

The velocity-potential lines about the aerodynamic form were obtained by cutting out from the center of the conducting sheet the exact shape of the form the flow around which was to be studied and then mapping the electric equi-potential lines; the latter corresponding to the velocity-potential lines of a perfect fluid. Lines drawn perpendicularly to these velocity-potential lines gave the stream-line flow about the obstacle. Hence, a complete stream-line pattern about an obstacle was obtained without even making a model of the obstacle.

In mapping the stream-line flow about a form directly, an accurate model of the obstacle, cut from a sheet of highly conducting material, was placed at the center of the conducting paper. To insure that this model of the obstacle made good contact with the paper, small holes were drilled in the model whereby it was tacked to the table top.

Quantitative results were obtained from the patterns by securing an equal drop in electric potential between all lines; this corresponding to an equal drop in the value of the velocity-potential function or in the value of the stream function from line to line. By means of the well-known properties of these functions, the velocity at any point in the vicinity of the obstacle can be obtained in terms of the velocity at some point far removed from the obstacle. This equal drop in the value of the functions between the lines was secured by keeping the fixed electrode in its original position on the first line and displacing the exploring electrode any arbitrary distance toward the obstacle, noting the galvanometer deflection. The fixed electrode was then placed at the new position and the second line was plotted; the location of the fixed electrode for the plotting of the third line being obtained in the same manner as the corresponding point for the second line. The potential difference between the terminals was kept constant, so that the deflection of the galvanometer had the same significance throughout the entire mapping operation.

This method has the advantage that the pattern is obtained directly on the paper which serves as a record of the experiment. This is made possible by using as electrodes two lead pencils, sharpened at both ends, one end being inserted into a short glass tube, and sealed therein with Kotinsky cement. Mercury is poured into this glass tube and a wire is inserted from the top of the tube which is closed with a cork stopper, thus keeping the mercury from spilling and at the same time securely holding the wire in the mercury.

The writer has made numerous patterns on paper about various forms. Those forms for which the flow patterns are furnished by hydrodynamic theory yielded results in satisfactory agreement with the theoretical patterns and irregular forms yielded results which indicated the type of flow patterns which were later obtained in actual wind-tunnel experiments. The ground effect[6] has been obtained both by the reflection method and by the wind-tunnel method of securing the effect by the introduction of a flat plate of large extent beneath the airfoil section, the flat plate being in this case simply one of the straight copper terminals. Circulation effects can be obtained, as in Relf's method, by the application of an electric potential to the model of the obstacle.

Although the paper gives sufficiently accurate results for laboratory instruction purposes, its irregularity reduces the accuracy of any quantitative determinations quite considerably. If, instead of the paper, some thin, very homogeneous substance, such as stainless steel, is used, greater accuracy is possible.

The writer has used a 1/32 inch thick sheet of stainless steel and has secured very accurate results. With thinner sheets and a very sensitive galvanometer, exceedingly accurate mapping is possible.

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[6] E. P. Warner, "Aerodynamics," McGraw-Hill, 1927.

SPECIAL ARTICLES

DOES DILUTE HEAVY WATER INFLUENCE BIOLOGICAL PROCESSES?

IN view of the appearance of a number of articles which describe stimulating action of dilute "heavy" water on biological processes, we think that some results which we have obtained in this field may be of interest. A summary of the published work has been presented by Barnes and Jahn.[1]

The "heavy" water used in our experiments was obtained from the Ohio Chemical Company. The original water was slightly cloudy, but was clear after an ordinary filtration. The water was then distilled through two Pyrex glass systems fitted with efficient spray traps. In each distillation the middle three fifths of the distillate was collected. The second distillate, which was used for the experiments, was analyzed by means of an interferometer and was found to contain 0.46 per cent. D_2O. For the controls

[1] T. C. Barnes and T. L. Jahn, *Quart. Rev. Biol.*, 9: 292–341, 1934.

ordinary water, which contains 0.02 per cent. D_2O, was collected from a large laboratory still and was passed through the same stills that were used for the 0.46 per cent. D_2O. The 0.05 per cent. D_2O, used in several experiments, was prepared by diluting the 0.46 per cent. D_2O with the control water.

The growth of *Aspergillus niger* was studied by the method described by Mann.[2] Standard Pfeffer solutions, prepared with the 0.46 per cent. D_2O and the ordinary H_2O, were sterilized, inoculated and kept in an incubator at 34° C. for 5 days. At the end of this period all the mats were alike in appearance; they were slightly convoluted, and their fruiting was plentiful and uniform. The mats were washed, dried for 3 days at 65° C. and weighed. The dry weights are given in Table 1.

TABLE 1

GROWTH OF ASPERGILLUS NIGER[a]

Exp.	No. of flasks of each kind of water	Average weight of mats, grams	
		H_2O	D_2O
1	3	0.452 ± 0.027	0.435 ± 0.005
2	10	0.224 ± 0.029	0.229 ± 0.025
3	10	0.161 ± 0.023	0.181 ± 0.016

[a] In experiments 1 and 2, 0.46 per cent. D_2O was used; in experiment 3, 0.05 per cent. D_2O. In the first experiment 50 cc of solution were used in a 125 cc flask; in the others 15 cc in a 50 cc flask. Experiments 1 and 2 were performed by different workers. The precision given is average deviation.

It may be seen that we found no marked difference in the weights of the mats grown in the ordinary H_2O and in the 0.46 per cent. D_2O. The weights are of the same order of magnitude as those obtained by Mann[2] with ordinary water. Considering the percentage error in such work, the difference in the weights in experiment 3 is not to be regarded as significant. Thus, our results, in contrast to those of Meyer,[3] indicate no stimulating effect of dilute D_2O on the growth of *Aspergillus*. It should be pointed out that the D_2O content of the water in a Pfeffer solution is probably not the same as that of the original water, owing to the exchange of the D atoms with the hydrogen of the hydroxyl groups in the sucrose.

A study was made of the percentage germination of conidia of the powdery mildew of wheat, *Erysiphe graminis tritici*, incubated in hanging drops of ordinary distilled water and in two low concentrations of heavy water. The preparations were kept in darkness for 10 hours at 15° C. The results are shown in Table 2.

TABLE 2

GERMINATION OF CONIDIA OF ERYSIPHE GRAMINIS TRITICI AFTER 10 HOURS AT 15° C.

Culture medium	pH	Number of spores counted	Number of spores germinated	Percentage germination
0.05 per cent. D_2O	5.7	1127	616	54.7
0.46 per cent. D_2O	5.7	1078	591	54.8
Control (dist. H_2O)	5.7	1133	618	54.5
Control (nutrient soln.)	5.5	441	236	53.5
Control (tap water)	7.2	1145	851	74.3

In the tap water control at pH 7.2 about 99 per cent. of the viable spores (about 75 per cent. of the total number) had germinated after 10 hours at 15° C. The percentage of germination was considerably lower in the other preparations (at pH 5.5–5.7), but it was the same in the 0.05 per cent. and 0.46 per cent. D_2O as in the ordinary distilled water.

The growth of wheat roots in 0.46 per cent. D_2O and in ordinary distilled H_2O was also studied. The culture method was essentially the same as that described in a previous paper.[4] Seeds of Marquis wheat were soaked in the appropriate water for 3 hours and then germinated on moist filter paper at 28° C. until the primary roots were about 6 mm long (approximately 25 hours). Uniform seedlings were then placed on paraffined bobbinet so that their roots could grow downward into water contained in a beaker.

TABLE 3

ROOT GROWTH OF WHEAT SEEDLINGS IN 96 HOURS AT 19°–20° C. (EACH FIGURE REPRESENTING THE AVERAGE OF 25 ROOTS)

Exp.	Primary roots, mm		Lateral roots, mm	
	H_2O	D_2O	H_2O	D_2O
1	74.1	83.8	.....	.....
	72.7	72.9	.....	.....
2	90.0	87.6	82.9	79.6
			85.4	79.2
	85.8	86.4	80.9	77.6
			81.3	78.8

[2] M. L. Mann, *Bull. Torrey Bot. Club*, 59: 443–490, 1932.

[3] S. L. Meyer, SCIENCE, 79: 210–211, 1934.

[4] S. F. Trelease and H. M. Trelease, *Bull. Torrey Bot. Club*, 53: 137–156, 1926.

Twenty-five seedlings were used for each beaker, and in each experiment 50 seedlings were used for the 0.46 per cent. D_2O and the same number for the H_2O. The cultures were kept in darkness at 19°–20° C. for 96 hours, and at the end of this period the roots were measured. The results, shown in Table 3, indicate no significant difference in the effects of 0.46 per cent. D_2O and ordinary H_2O on the root elongation of the wheat seedlings.

The rate of the respiration of wheat seedlings at 28.5° C., as indicated by O_2 consumption, was measured by means of Warburg manometers. The seeds were soaked in the appropriate water for 3 hours and then allowed to germinate for about 24 hours on moist filter paper at 28° C. in a dark incubator. At the end of this period there was no difference in the appearance of the seedlings. Seedlings of the same root length were then placed on moist filter paper in the Warburg vessels. In each experiment three vessels, each containing 8 seedlings, were used for the dilute D_2O and three for the ordinary H_2O.

No difference was found in the rate of O_2 consumption by the seedlings in dilute D_2O and H_2O. The plot of O_2 consumption against time for the seedlings in each vessel gave practically a straight line over the period of an experiment (approximately ¾ hour). In each experiment the six lines (three for dilute D_2O and three for ordinary H_2O) lay close to one another, in a random order. The numerical data are given in Table 4.

TABLE 4

OXYGEN CONSUMPTION BY WHEAT SEEDLINGS[a]

Exp.	Root length of seedlings used, mm	O_2 consumption by 8 seedlings, cmm/min.	
		H_2O	D_2O
1	1–3	2.92	2.93
2	3–5	3.04	3.02
3	1–3	2.84	2.96
4	1.5–3.5	3.03	3.05
5	3.5–6	3.28	3.26
6	1–3	2.87	2.82

[a] The rate given is the average from 3 vessels, the average deviation being less than ± 4 per cent. In experiments 1 to 4, 0.46 per cent. D_2O was used; in 5 and 6, 0.05 D_2O. In experiment 6 quartz sand was used instead of filter paper.

These results may be summarized by saying that in the investigation of four biological processes—namely, growth of *Aspergillus*, germination of conidia of *Erysiphe graminis tritici*, root growth of wheat and O_2 consumption by wheat seedlings—no significant difference was observed between the influence of dilute heavy water and that of ordinary water.

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PITYROSPORUM OVALIS AS A CAUSATIVE AGENT OF SEBORRHEIC DERMATITIS

IT has been popularly considered by many dermatologists that *Pityrosporum ovalis*, the so-called "bottle bacillus" of Unna, is the etiological agent of seborrhea capitis simplex (dandruff) and seborrhea corporis (scaling of the body). Unfortunately, the inability to grow the organism for any length of time kept the clinicians from proving this belief in compliance with Koch's postulates. The organism is a yeast-like, budding, non-filamentous fungus, ovoid to spherical in form. When seen in scales, the cells are usually bottle- or gourd-shaped, ovoid and thin-walled, 2–4 × 2–3 μ in size, or spherical and thick-walled, 3–9 μ in diameter.

Because of its supposed relationship to bacteria, early investigators used bacteriological media for cultivating the microbe, with no success. Later workers, finding it to be a fungus, had somewhat better results using mycological substrates. No one had been able to cultivate *Pityrosporum ovalis* beyond one or two subcultures. One of the writers (Moore) inoculated fresh slants of wort agar (product of the Digestive Ferments Company), pH 4.8, with scales from scalps having seborrhea and was able to grow the fungus in approximately 12 per cent. of the attempts (8 out of 90). The microbe was successfully subcultured and used in experiments to test its pathogenicity, or at least its rôle in seborrhea.

Laboratory animals, including rabbits, guinea pigs, rats, white mice and hairless mice, were inoculated as follows: Intradermally with a saline suspension; percutaneously (scratching the skin) with and without a lipid salve; cutaneously; and controls. Rabbits and guinea pigs gave favorable reactions with percutaneous inoculations. Mice, rats and hairless mice were negative.

A number of humans were inoculated as were the animals and, in addition, auto-inoculations with scales from the patient's scalp were made on the chest and in the axillae. The percutaneous inoculation with the application of whole culture of *Pityrosporum ovalis* produced seborrheic dermatitis in 50 per cent. of the patients, while the same inoculation with the rubbing in of a lipid salve gave approximately 85 per cent. reactions. Intradermal injections produced a distinct erythema in approximately 75 per cent. of the cases. Cutaneous tests were not very convincing, while auto-

inoculations were successful in 50 per cent. of the attempts. The controls were negative in over 90 per cent. of the patients. These results seem to indicate that *Pityrosporum ovalis* may produce seborrheic dermatitis under favorable conditions.

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A DWARF MUTATION IN THE RAT

IN rodents genetic dwarfs have been reported in the guinea pig,[1,2] in the mouse by Snell[3] and recently in the rabbit by Green, Hu and Brown.[4] The dwarfism in the mouse was shown by Smith and MacDowell[5] to be caused by a hereditary deficiency of the anterior pituitary. Preliminary studies in the rabbit suggest that the defect may be due to an endocrine abnormality, while in the guinea pig the nature of the dwarfism was not determined.

The dwarf mutation in the rat described herein was first observed in our colony in the summer of 1933. It appeared as one individual in a litter of nine young in a strain of rats that had been closely inbred in our laboratory for several years. Shortly afterward another dwarf was observed in a litter from a closely related pair, and subsequently in the litters of other closely related rats. At present 22 dwarfs have been produced in 12 litters, the ratio of normal to dwarf in these litters being 80 to 22. These results suggest that the dwarf is the result of a simple autosomal recessive mutation, the appearance of both dwarf males and females showing that the gene is not sex-linked.

At birth normal and dwarf rats can not be distinguished, and it is impossible to separate the dwarf rats with certainty until about the twelfth day after birth. At this time a distinct difference in rate of growth becomes manifest, and the hair of the dwarfs appears much thinner and of finer texture than the hair on their normal litter mates. This difference in the hair is a characteristic feature of the dwarfs throughout life. The mature weight of the dwarfs is approximately 50 per cent. that of the normal males and 70 per cent. of the normal females of this strain. A remarkable feature is the failure of the males and females to become differentiated in size, whereas the male normally becomes distinctly larger than the female.

Thus far all dwarfs have proven to be sterile. No sexual activity has been observed in dwarf males and in only one instance has copulation been noted among the dwarf females. The size of the testes remains infantile, becoming less than one-half normal size. Spermatogenesis occurs, but at a greatly reduced rate, and the few sperm observed were abnormal in appearance. As yet studies have not been made of the ovary.

In all cases so far observed a distinct opacity of the lens of the eyes has been associated with the dwarfism, although some variation in the degree of this opacity exists. Skeletons of the dwarfs have not been prepared, but the general proportion of the body parts appears the same as in normal rats. The effect seems to be a general reduction in size of all parts, and the retardation in rate of growth becomes manifest at a very early date. Using the method of analysis of variance on the weights of litters in which dwarfs appeared, it has been determined that the retardation in growth had begun on the fifth day. As pointed out above, however, individual dwarfs can not be separated with certainty until about the twelfth day after birth. The dwarf rats are weaker than normals, are more susceptible to infections, and are shorter lived.

Individuals heterozygous for the dwarf gene are normal in appearance, in vitality and they attain the same size as homozygous normal rats. Recently, however, some individuals have been observed among the progeny of dwarf-producing pairs that were slightly slow in developing their hair and whose early growth seemed somewhat retarded. Tests are now under way to determine whether such individuals are heterozygous for the dwarf gene.

The decreased size of the dwarf rats, their sterility and their general appearance suggests that the defect may be of endocrine origin. It is, however, apparently not due to a pituitary deficiency, since in preliminary tests with the implantation of pituitary bodies from normal rats, following the technique of Smith and MacDowell, growth was not produced in treated dwarfs. Further experiments to determine the physiologic cause of this dwarfism are at present under way and the colony is being expanded in order to insure a constant supply of the dwarfs.

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[1] I. J. B. Sollas, Repts. Evol. Com. Roy. Soc., 5: 51–79, 1909.
[2] I. J. B. Sollas, *Jour. Gen.*, 3: 201–204, 1914.
[3] G. D. Snell, *Proc. Nat. Acad. Sci.*, 15: 733–734, 1929.
[4] H. S. N. Green, C. K. Hu and W. H. Brown, SCIENCE, n. s., 79: 487–488, 1934.
[5] P. E. Smith and E. C. MacDowell, *Anat. Rec.*, 46: 249–257, 1930.

BOOKS RECEIVED

CAULLERY, MAURICE. *French Science.* Pp. xi + 229. Illustrated. Author.
EDDINGTON, SIR ARTHUR. *New Pathways in Science.* Pp. x + 333. 4 plates. Macmillan. $3.00.